# PATENT COOPERATION TREATY

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## INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

| Applicant's or agent's file reference P27426PC00/AA | FOR FURTHER ACTION | See Form PCT/IPEA/416 |
|---|---|---|
| International application No. PCT/NL2004/000573 | International filing date *(day/month/year)* 13.08.2004 | Priority date *(day/month/year)* 15.08.2003 |
| International Patent Classification (IPC) or national classification and IPC G01R33/07 | | |
| Applicant SYSTEMATIC DESIGN HOLDING B.V. et al. | | |

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 2 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

| | | |
|---|---|---|
| ☒ | Box No. I | Basis of the opinion |
| ☐ | Box No. II | Priority |
| ☐ | Box No. III | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| ☐ | Box No. IV | Lack of unity of invention |
| ☒ | Box No. V | Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| ☐ | Box No. VI | Certain documents cited |
| ☐ | Box No. VII | Certain defects in the international application |
| ☐ | Box No. VIII | Certain observations on the international application |

| Date of submission of the demand | Date of completion of this report |
|---|---|
| 14.06.2005 | 19.09.2005 |
| Name and mailing address of the international preliminary examining authority: European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016 | Authorized Officer Modesto, C Telephone No. +31 70 340-1055 |

# INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/NL2004/000573

## Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

**Description, Pages**

| | |
|---|---|
| 1-15 | as originally filed |

**Claims, Numbers**

| | |
|---|---|
| 2-11, 13-15 | as originally filed |
| 1, 12 | received on 14.06.2005 with letter of 14.06.2005 |

**Drawings, Sheets**

| | |
|---|---|
| 1/2, 2/2 | as originally filed |

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

**Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

| | | | |
|---|---|---|---|
| Novelty (N) | Yes: | Claims | 1-15 |
| | No: | Claims | |
| Inventive step (IS) | Yes: | Claims | 1-15 |
| | No: | Claims | |
| Industrial applicability (IA) | Yes: | Claims | 1-15 |
| | No: | Claims | |

2. Citations and explanations (Rule 70.7):

**see separate sheet**

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement.**

1 In this communication reference is made to the following documents (D1, D2), the numbering will be adhered to the rest of the procedure:

D1: US-A-5 747 995
D2: EP-B-1 206 707

2 Claim 1 relates to a method for measuring an entity of a magnetic field using an Hall sensor. Claim 12 relates to the correspondent apparatus.

3 The closest prior art document D1 also discloses a method and apparatus for measuring an entity of a magnetic field using an Hall sensor in accordance with the preamble of claims 1 and 12. D2 discloses similar arrangements.

4 Vis-a-vis these known methods and apparatus, the difference between the present application and the closest prior art is the fact that the current application uses a voltage source which has an impedance that is negligible for use of the sensor and the processing circuit has a negligible input impedance therefore allowing the tapping of the detection signal as a short-circuit current (instead of a voltage).

4.1 These distinguishing features solve the problem of improving the accuracy and sensitivity of integrated Hall sensors.

4.2 Tapping off a current instead of a voltage allows better compensation for non-linear offset terms when using Hall plates. None of the cited/consulted documents disclose or suggest an arrangement wherein voltage excitation and current detection is employed. Hence, since this solution was never disclosed nor hinted in any of the prior art documents and since this solution does not appear to be obvious for the skilled man and does not occur without the exercise of inventive activity, the present application appears to meet the requirements of Article 33(1) PCT.

5 The dependant claims 2-11 and 13-15 define further refinements of the new and inventive idea of claims 1 and 12, and meet the requirements of Article 33 PCT for the same reasons as given above.

6 The industrial applicability of the method and apparatus of claims 1 and 12 is considered to be evident, so that therefore all the requirements of Article 33 PCT appear to be met by claims 1-15.

CLAIMS

(95)

1. Method for measuring an entity of a magnetic field using a Hall sensor, which is provided with at least one Hall plate (101, 102, 103, 104) which includes a group of two pairs ((A1, A2), (B1, B2)) of terminals (A1, A2, B1, B2) located at a distance from one another, an excitation signal being supplied from a source to one pair of terminals, and a detection signal, which forms a representation of the entity, being tapped off from the other pair of terminals by a processing circuit, characterized in that the source is a voltage source (105) of ~~negligible impedance~~, and the processing circuit has a negligible input impedance ~~and taps~~ off the detection signal as a current.

2. Method according to claim 1, characterized in that the measurement of the entity is carried out in cycles of in each case four sub-measurements, to provide four measured values for the entity, with the pairs of terminals of the plates being alternately connected to the voltage source and to the processing circuit, the polarity of the voltage source being reversed during two sub-measurements with respect to the other two sub-measurements.

3. Method according to claim 2, characterized in that the processing circuit amplifies the detection signal prior to processing of the detection signal.

4. Method according to claim 2 or 3, characterized in that the processing of the four measured values comprises the reversing of the polarity of the measured values of the two sub-measurements for which the polarity of the voltage source was reversed with respect to the other two sub-measurements, and the measured values of the two other sub-measurements and the two measured values with reversed polarity are summed.

5. Method according to one of claims 2 to 4, characterized in that Hall plates which are made from n-type silicon semiconductor material are used.

6. Method according to claim 5, characterized in that if the said

<which an impedance is negligible for use of the sensor>
<< For tapping >> << short-circuit >>>

four successive sub-measurements, and for each sub-measurement the four measured values obtained last are summed to give a processed measured value for the variable.

12. Apparatus for measuring an entity of a magnetic field using a Hall sensor, which is provided with at least one Hall plate (101, 102, 103, 104) which has a group of two pairs ((A1, A2), (B1, B2)) of terminals (A1, A2, B1, B2) located at a distance from one another, one pair of terminals being connected to a source for supplying an excitation signal to the one pair of terminals, and another pair of terminals being connected to a processing circuit for tapping off and processing a detection signal from the other pair of terminals, characterized in that the source is a voltage source (105) of ~~negligible impedance~~, the processing circuit has a negligible input impedance ~~and taps~~ off the detection signal as a current.

13. Apparatus according to claim 12, characterized in that switching means are arranged, which, in accordance with a method according to one of the preceding claims, alternately connect the pairs of terminals to the source and the processing circuit between the pairs of terminals and the source and the processing circuit.

14. Apparatus according to claim 12 or 13, characterized in that four Hall plates are provided in a square formation and integrated in a single substrate, the groups of terminals of the Hall plates being oriented in such a manner with respect to a perpendicular to a main plane of the plates that one group of terminals of a Hall plate is rotated through 90° with respect to a group of terminals of an adjacent Hall plate, in a direction which is opposite to the direction in which the other Hall plate follows the one Hall plate, and the same terminals are connected to one another in accordance with the different orientation for adjacent plates.

15. Apparatus according to one of claims 12 to 14, characterized in that a wiring is connected to the terminals of the Hall plates, the wiring having an arrangement which is such that currents running from and to the voltage source (105) generate magnetic fields which substantially cancel one another out in the main plane of the Hall